Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	}	
	}	
2002 Biennial Review of Telecommunications	}	ET Docket No. 02-312
Regulations Within the Purview of the	}	
Office of Engineering and Technology	}	

REPLY COMMENTS OF MULTISPECTRAL SOLUTIONS, INC.

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Multispectral Solutions, Inc. ("MSSI") is pleased to submit these reply comments in response to the "Comments of Preco Electronics, Inc."[1] which were submitted earlier in this proceeding. MSSI is a world-recognized developer and manufacturer of ultra wideband (UWB) systems and devices, and has been an active participant in ET Docket 98-153, "Revision of Part 15 of the Commission's Rules Regarding Ultra-Wideband Transmission Systems."

§15.35 Measurement Detector Functions and Bandwidths

Referring to the significant difficulties it has had in achieving compliance of its line of small, low-powered, short-range, object-detection radar systems to Part 15 rules (specifically §15.35), Preco Electronics, Inc. ("Preco") noted "[o]ne of the most significant factors in our difficulty has come from the FCC's own shifting interpretation of the sparse Part 15 rules applicable to pulsed-emission devices."

Indeed, the FCC's capricious reinterpretations of §15.35 regarding pulse desensitization correction (PDC) (see Appendix A below) – one of the more recent occurring on 14 May 2002 – have also been a tremendous hindrance to bringing ultra wideband devices to market in a manner consistent with the myriad interests of existing spectrum users.

For example, a short pulse system (regardless of its applicability) operating in the §15.205 **non-restricted** band 5.46 – 7.25 GHz under §15.209 limits, must now limit its

[1] "Comments of Preco Electronics, Inc.," In the Matter of 2002 Biennial Review of Telecommunications Regulations Within the Purview of the Office of Engineering and Technology, ET Docket No. 02-312, 18 October 2002.

full bandwidth peak power to -21.25 dBm (14 May 2002 FCC interpretation of §15.35). That is, PDC is now required in the compliance measurements for such devices. (Interestingly, pulse desensitization is precisely the reason that UWB devices have low interference in the first place!)

However, the same system, operating under the new Subpart F UWB rules can achieve a *peak power density* of 0 dBm/MHz which, for a 500 MHz minimum UWB bandwidth, translates into a full bandwidth peak power of +20 dBm, **fully 41.25 dB higher peak power than the FCC permits for Part 15 devices under its previous rules**. Note that, in addition, **this "higher power" can now be used in previously restricted bands**:

3260 – 3267 MHz
3332 – 3339 MHz
3345.8 – 3358 MHz
3600 – 4400 MHz
4.5 – 5.15 GHz
5.35 – 5.46 GHz
7.25 – 7.75 GHz
8.025 – 8.5 GHz
9.0 – 9.2 GHz
9.3 – 9.5 GHz.

Thus, rather than encouraging responsible use of *existing* spectrum, the FCC by its reinterpretation of §15.35 has encouraged short pulse devices to operate in previously restricted regions of spectrum.

Fortunately, there is an extremely simple solution to this problem, and one consistent with the 15 year record with respect to §15.35 and the nearly 5 year record with respect to the new UWB rules under Subpart F. Namely,

The FCC should clarify that pulse desensitization correction is NOT required above 1 GHz.

This solution has numerous positive consequences:

(1) The FCC would enable the responsible use of short pulse devices in non-restricted bands of operation – e.g., 5.46 – 7.25 GHz, 8.50 – 9.0 GHz, 9.5 – 10.6 GHz, etc. The peak power *density* levels, now -21.25 dBm/MHz (rather than -21.25 dBm full bandwidth peak) would be adequate to enable a wide variety of UWB applications – tagging, radar, geopositioning, wireless PANs and LANs, etc. Since these applications would now take place in non-restricted bands, the concerns about potential interference to GPS, PCS, SDARS, AM/FM/TV broadcast, etc. noted by numerous respondents to ET Docket 98-153 would no longer be an issue;

(2) The specification of -21.25 dBm/MHz (i.e., 20 dB higher than the maximum permissible average power density of -41.25 dBm/MHz) would now be consistent with the newly created Subpart F rules which also specify a peak

power density. Thus, operation of UWB devices in restricted bands between 3.1 and 10.6 GHz would be limited to -34 dBm/MHz (i.e., 0 dBm/50 MHz), which is a full 12.75 dB *lower* than that permitted in non-restricted bands of operation. This is indeed consistent with the vast record in ET 98-153;

(3) Finally, the removal of PDC correction above 1 GHz, or equivalently the specification of a maximum peak power *density*, would put Part 15 on a solid footing for considering the real effects of interference on systems of arbitrary bandwidths. This is a particularly critical need for establishing consistent limits for future wideband systems which have not yet even been dreamed about.

Respectfully submitted,

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Appendix
Excerpts from MSSI Petition for Reconsideration in ET Docket 98-153

THE NEW UWB RULES, TAKEN INTO CONTEXT WITH RECENT FCC ACTIONS, CONFLICT WITH EXISTING PARTS 15.35 AND 15.209 OF THE COMMISSION'S RULES.

In its grant of waivers (15 June 1999) to Time Domain Corporation, U.S. Radar Inc. and Zircon Corporation, the Commission stated that

> *"**The specific rules waived are**: Section 15.205(a), which specifies that only spurious emissions may be placed in certain designated restricted frequency bands of operation; and, **Sections 15.31 and 15.35 which require the application of a pulse desensitization correction factor when performing certain measurements below 1000 MHz**."*[2] (**Bold** emphasis added.)

Note that §15.35(b) of the Commission's Rules states that

> *"On any frequency of [sic] frequencies above 1000 MHz, the radiated limits shown are based upon the use of measurement instrumentation employing an average detector function. When average radiated emission measurements are specified in the regulations, including emission measurements below 1000 MHz, there is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit for the frequency being investigated unless a different peak emission limit is otherwise specified in the rules, e.g. see Section 15.255. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1 MHz. Measurement of AC power line conducted emissions are performed using a CISPR quasi-peak detector, even for devices for which average radiated emission measurements are specified."*

Thus, the FCC reconfirms in its grant of waivers for UWB technologies that pulse desensitization correction (PDC) is required for emissions *below* 1 GHz; while §15.35(b) further stipulates that measurements (both peak and average) *above* 1 GHz are performed using a minimum resolution bandwidth of 1 MHz with *no mention of a need for pulse desensitization correction*.

Historically, in its Notice of Proposed Rule Making (FCC 87-300) relating to Part 15 devices which first established §15.35, the Commission wrote:

> *"[T]he use of a CISPR quasi-peak detector, as described in CISPR Publication 16, gives a **better indication of the interference potential of a signal since it***

[2] FCC Public Notice, "The Office of Engineering and Technology Grants Waivers for Ultra-Wide Band Technologies," FCC 99-1340, 8 July 1999.

> ***provides a closer representation of the power density of the radiated signal****, accounting for the peak emissions."*[3] (**Bold** emphasis added.)

Thus, the FCC also admits that it is the "*power-density of the radiated signal"*, or Watts/Hz, that is a "*better indication of the interference potential*". Furthermore, in the subsequent First Report and Order (FCC 89-103), the Commission states:

> *"[W]e have deleted the requirement that 'suitable adjustment' must be made to the measured results for emissions that are wider than the bandwidth of the measuring instrument. Such adjustments are not needed with the use of CISPR quasi-peak measurements as these measurements* ***determine the permitted emission level per unit bandwidth*** *anywhere within the entire range of frequencies emitted by the Part 15 device. Thus, the* ***measurement procedure is effective in controlling interference potential without a corresponding need to integrate the measured field strength to a high level simply because the Part 15 device is broadbanded****."*[4] (**Bold** emphasis added.)

Again, the Commission confirms that it is unnecessary to integrate the measured field strength, or equivalently, to limit full bandwidth peak power, to protect systems which may be affected by broadband Part 15 devices.

Recently, MSSI submitted a UWB device for FCC certification. NTIA tested an early version of this device[5] – Device "A" of the referenced report. With a 1 MHz resolution bandwidth, the MSSI UWB device exhibited an average power which was 35 dB *below* Part 15 limits of 500 μV/m at 3 meters[6], and exhibited a worst case peak power at 5700 MHz of 75 dBμV/m (5623 μV/m) at 1 meter; or, equivalently, 1874 μV/m at 3 meter range[7]. Thus, with a 20 dB peak-to-average ratio limitation as specified in §15.35(b), the UWB device exhibited a peak power which was 8.5 dB *below* Part 15 limits of 5000 μV/m at 3 meters. The device had a pulse repetition frequency (PRF) of 10 Kpps (10,000 pulses per second).

As the MSSI UWB device had a portion of the main spectral lobe falling within the §15.205(a) restricted band 5.35 to 5.46 GHz; the device was redesigned to operate at a slightly higher operational frequency to stay within the 5.46 to 7.25 GHz non-restricted

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[3] FCC 87-300, "Notice of Proposed Rule Making – Revision of Part 15 of the rules regarding the operation of radio frequency devices without an individual license," released October 2, 1987.

[4] FCC 89-103, "First Report and Order – Revision of Part 15 of the Rules regarding the operation of radio frequency devices without an individual license," released April 18, 1989.

[5] Kissick, W.A., editor, "The Temporal and Spectral Characteristics of Ultrawideband Signals," U.S. Department of Commerce, NTIA Report 01-383, January 2001.

[6] Kissick, W.A., Figure D.A.23, page D-A-14.

[7] Kissick, W.A., Figure 8.3, page 8-5.

region. (Note: The original device "A" was also tested by an FCC-certified testing laboratory and MSSI was told that the unit passed §15.209 general emission limits, but failed the §15.205(a) criterion for intentional emissions in restricted bands.)

Upon frequency redesign, the UWB device was again tested by the same laboratory, and MSSI was notified that the unit was now fully compliant with §15.35, §15.205(a) and §15.209. The new UWB device has an operational frequency range of 6.1 to 6.6 GHz and an operational PRF of approximately 30 Hz. The unit was tested by the certification laboratory at its worst case PRF of 100 Kpps, which represented a test mode for the device. Final documentation processing for the device for Part 15 certification was scheduled for May 15, 2002.

On 15 May 2002, MSSI was notified by the certification laboratory that the FCC had held a teleconference the day before (on 14 May 2002) with all of its TCBs (Telecommunication Certification Bodies). The FCC notified the TCBs that it was now necessary to take into account pulse desensitization when considering pulsed emissions, regardless of the operational frequency of the device. At that point, MSSI contacted Mr. John Reed from the FCC's Office of Engineering and Technology (OET) for clarification. Mr. Reed indicated that §15.35 was to be interpreted as limiting the *total peak power* for a Part 15 device to -21.25 dBm (*numerically* 20 dB above the -41.25 dBm/MHz average limit), and that this limit was a "full bandwidth" limit. That is, -21.25 dBm represented the total peak power as measured in the full bandwidth of the pulse, not in the "greater than 1 MHz" bandwidth as specified in §15.35(b). Pulse desensitization correction was now necessary for *all* frequencies, irrespective of whether the emission fell above or below 1 GHz.

However, in its First Report and Order (FCC 02-48) for Ultra Wideband technology, the FCC clearly states:

> *"…we believe that our proposal to permit a peak emission within a 50 MHz RBW of only -21.25 dBm EIRP is too conservative. We believe that the peak emission level of 0 dBm/50 MHz, equivalent to 58 mV/m at 3 meters, requested by TDC would not result in harmful interference problems to communications systems. This level translates to a peak EIRP of -24.44 dBm/3 MHz or 3.6 μW/3 MHz, or to a peak field strength of 3.46 mV/m at [sic] measured at 3 meters with a 3 MHz RBW.* ***This peak level is*** *16.8 dB higher than the average level determined with a 1 MHz RBW and is* ***3.2 dB lower than the peak limit permitted under the current Part 15 rules****."*[8] (**Bold** emphasis added.)

Thus, according to the UWB First Report and Order, 0 dBm/50 MHz peak EIRP is 3.2 dB lower than the peak limit permitted under current Part 15. Indeed, 0 dBm/50 MHz results in a peak field strength of 3,460 μV/m which is 3.2 dB below the 5,000 μV/m

[8] FCC 02-48, First Report and Order – Revision of Part 15 of the Commission's Rules Regarding Ultra-Wideband Transmission Systems," adopted February 14, 2002; released April 22, 2002.

peak limit imposed by §15.35 *if measured in a 3 MHz bandwidth*. Note that §15.35 only specifies that the bandwidths exceed 1 MHz for measurements.

Now, if §15.35 limits are indeed -21.25 dBm for *total full bandwidth power*, consider a 500 MHz bandwidth UWB signal, the minimum bandwidth required above 3.1 GHz under the new rules. According to the new rules, the peak signal power can be 0 dBm/50 MHz, for a *total full bandwidth power of +20 dBm*. (Note that peak power increases as 20 log bandwidth.) This peak power, according to the FCC's new "interpretation" of §15.35, is ***41.25 dB higher than Part 15 "limits" (-21.25 dBm full bandwidth power).*** This is an obvious contradiction.

Figure 1 graphically illustrates the problem with FCC's 15 May 2002 re-interpretation of §15.35.

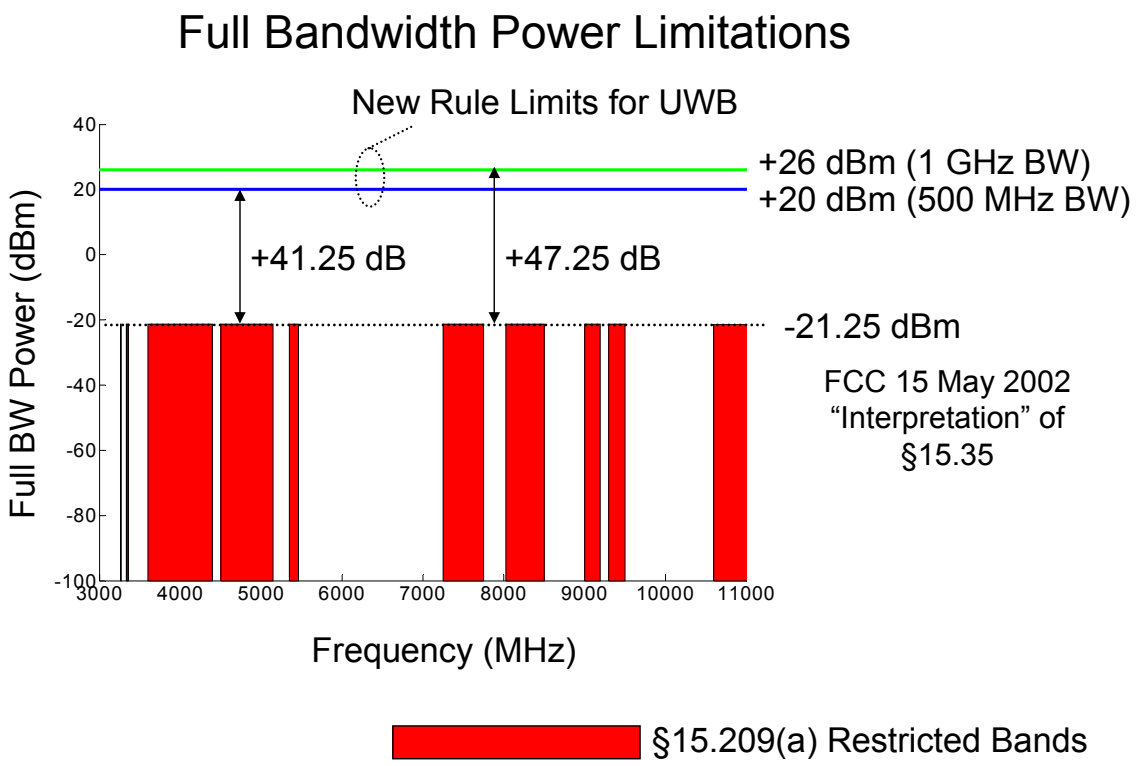

Figure 1. Inconsistencies between FCC re-interpretation of §15.35 and UWB R&O.

Thus**, if pulse desensitization correction is required above 1 GHz, then UWB emissions under the new Subpart F would be a *minimum* of 41.25 dB *or 13,335 TIMES HIGHER THAN EXISTING PART 15 LIMITS WITH THESE HIGHER EMISSIONS NOW OCCURRING IN PREVIOUSLY RESTRICTED BANDS*.** There is not a single comment relating to this issue in the entire UWB proceeding; nor do the FCC's briefing charts on the UWB R&O reflect this interpretation. Concerned spectrum users will indeed be shocked to learn what the actual approved UWB power levels represent. Thus, it must be concluded that the FCC's new "interpretation" of the existing

law (i.e., §15.35 and §15.209) is inconsistent with the present UWB First Report and Order.

Proposed Changes

The FCC must not arbitrarily and capriciously re-interpret existing Part 15 regulations, specifically §15.35 and §15.209:

If the FCC now believes that pulse desensitization correction is required *above* 1 GHz, and that -21.25 dBm was the previous Part 15 limit on *full bandwidth peak power*; then the peak power limit of 0 dBm/50 MHz as specified in the UWB First Report and Order is a minimum of 41.25 dB *higher* than that specified in Part 15. To be consistent with Part 15 and the vast record in this proceeding, the FCC must limit the *full bandwidth peak power* of UWB emissions to -21.25 dBm, for there is no discussion in this docket of permitting emission levels (whether peak or average) higher than existing Part 15.

If the FCC wishes to retain the limitation of 0 dBm/50 MHz for UWB emissions as stated in the UWB First Report and Order; then it is imperative that the FCC correctly interpret §15.35(b) as not requiring pulse desensitization correction above 1 GHz. To clarify this issue, the FCC should modify §15.35(b) in the current First R&O to explicitly state this fact. Note that this interpretation would still maintain a limit on peak emissions (i.e., no greater than 20 dB above the maximum average emission), but would measure such emissions appropriately as *peak spectral density* as originally intended in the vast record of documents and testimony related to §15.35.